NAVSHIPS 0967-374-3010

TECHNICAL MANUAL

for

SIGNAL GENERATOR

SG-823/URM-144

DEPARTMENT OF THE NAVY

NAVAL ELECTRONICS SYSTEMS COMMAND

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Approved: 25 November 1969

PAGE NUMBERS	CHANGE IN EFFECT	PAGE NUMBERS	CHANGE IN EFFECT
Title	Original	3-1 to 3-4	Original
ii to v	Original	4-1 to 4-10	Original
1-0 to 1-2	Original	5-1 to 5-8	Original
2-1 to 2-2	Original	6-1 to 6-6	Original

Probescope Co. Inc., 211 Robbins Lane, Syosset, New York 11791

Contracts: NObsr-95289; N600(24-126)64331; N00024-67-C-1419

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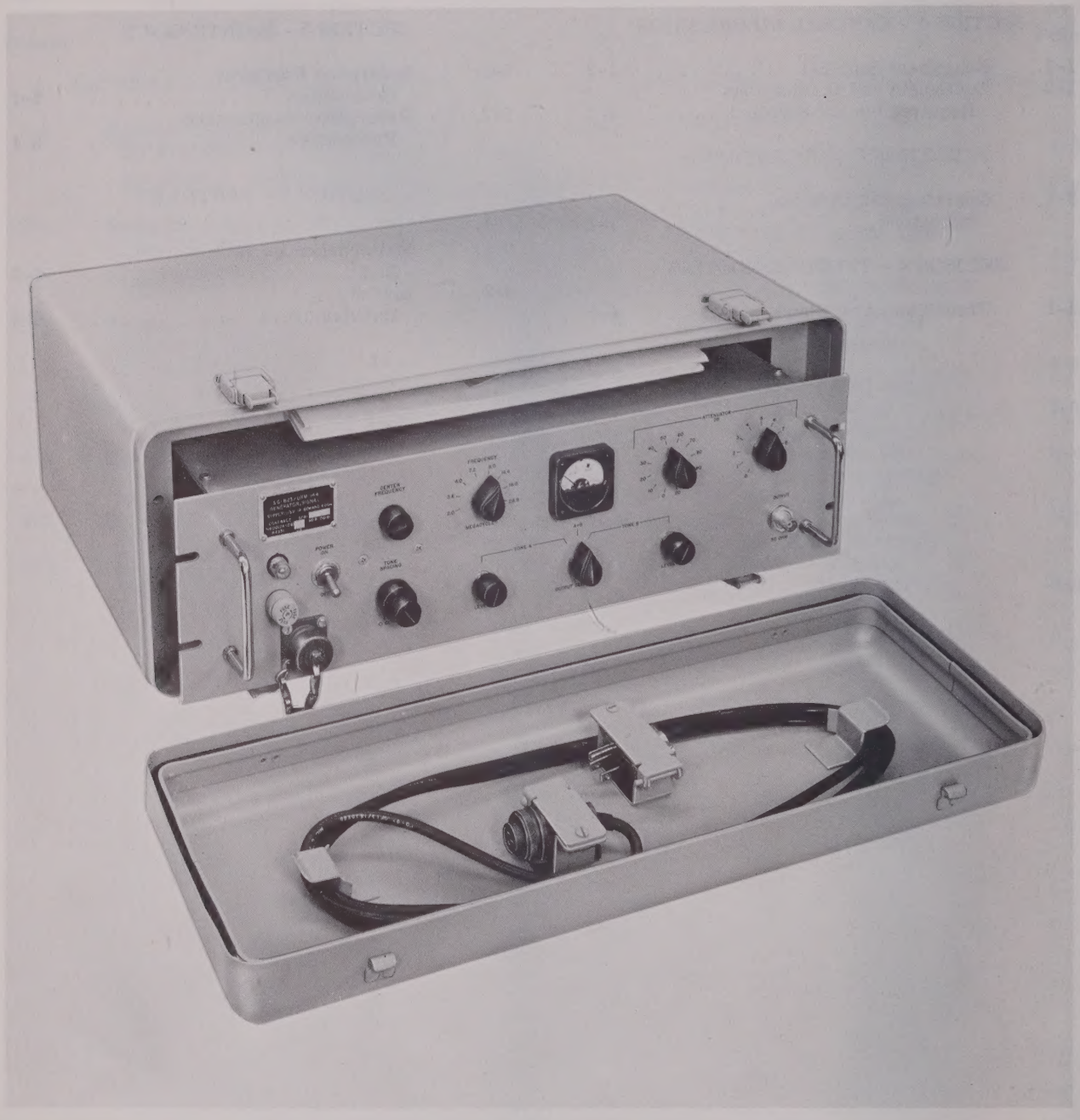


Figure 1-1. Signal Generator SG-823/URM-144

SECTION 1

GENERAL INFORMATION

-1. SCOPE.

This Technical Manual is in effect upon receipt nd does not supersede any previously issued ublications. Extracts from this publication may be nade to facilitate the preparation of other Depart- nent of Defense publications.

-2. GENERAL DESCRIPTION.

Signal Generator SG-823/URM-144 (figure 1-1) levelops a pair of distinct rf signals. The two rf signals are separated by an adjustable af signal difference and are of equal amplitude. The rf signals can be selected individually or in combination. When he two rf signals are selected together, the resulting output signal consists of the simple sum of the rf signals with no intermodulation effects. The signal generator is used to measure receiver sensitivity and distortion in SSB (single sideband) transmitters and receivers by providing two rf signals of known and adjustable levels at selected frequencies. The maximum output signal voltage level for both rf signals is 100,000 microvolts rms (root mean square), at a nominal impedance of 50 ohms. The signal generator may be rack-mounted in a standard, 19 - inch rack, or used in its standard combination carrying case.

1-3. REFERENCE DATA.

The electrical characteristics of the signal generator are listed below. All values are nominal.

a. FREQUENCY RANGE. Each of the two rf oscillator-multipliers (tone A and tone B) is capable of producing the following eight frequencies: 2.0 mc (megacycles), 3.6 mc, 4.0 mc, 7.2 mc, 8.0 mc, 14.4 mc, 16.0 mc, and 28.8 mc. The rf oscillators can be simultaneously adjusted over a range of ±0.05 percent of the selected output frequency. In addition, the tone B rf oscillator frequency can be individually varied over a range of ±0.025 percent of the selected frequency.

b. FREQUENCY CONTROL. Both rf oscillators employ crystal frequency control.

c. TYPES OF EMISSION. Two unmodulated incoherent sine wave rf signals, or an individual unmodulated sine wave rf signal.

d. OUTPUT LEVEL. An rf signal of 100,000 microvolts rms is produced in both the single and dual output modes that can be attenuated up to 120-db in 1-db increments. (0 dbm corresponds to 1 milliwatt into 50 ohms.)

e. OUTPUT IMPEDANCE. The nominal output impedance of the signal generator is 50 ohms.

f. FREQUENCY ACCURACY. The frequency accuracy is ±0.002 percent with a stability of 0.0005 percent for each 5 minute period after one-half hour warm-up.

g. DISTORTION. Hum, noise, and intermodulation distortion are at least 60 db below maximum signal level.

h. AMBIENT TEMPERATURE LIMITS. The ambient temperature limits are 0°C to +50°C.

i. INPUT POWER. Input power requirements are 115 volts ±10%, single phase at 60 cps ±5% or 400 cps ±10%, 10 watts.

1-4. EQUIPMENT SUPPLIED.

Table 1-1 lists the equipment supplied, including overall dimensions, volume and weight.

1-5. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED.

Table 1-2 lists the equipment and publications required but not supplied. Sufficient characteristics are included in the table to permit selection of suitable equipments.

1-6. FACTORY OR FIELD CHANGES.

No factory or field changes have been made on the SG-823/URM-144 signal generator.

1-7. PREPARATION FOR RESHIPMENT.

No extraordinary precautions are required to prepare the signal generator for reshipment.

TABLE 1-1. EQUIPMENT SUPPLIED

QTY PER EQUIP	NOMENCLATURE		OVERALL DIMENSIONS (IN.)			VOLUME (CU FT)	WEIGHT (LB)
	NAME	DESIGNATION	HEIGHT	WIDTH	DEPTH		
1	Signal Generator	SG-823/URM-144	5-7/32	19	12-7/16	.75	25
1	Combination Case		6	20	13	.80	5
1	Cable Assembly		96 in. lg.				
2	Technical Manual for Signal Generator SG-823/URM-144	NAVSHIPS 0967-374-3010	11.5	9.5	1		

TABLE 1-2. EQUIPMENT AND PUBLICATIONS REQUIRED BUT NOT SUPPLIED

QTY PER EQUIP	NAME	DESIGNATION	REQUIRED USE	SIGNAL GENERATOR SG-823/URM-144 EQUIPMENT CHARACTERISTICS
1	Frequency Counter	Hewlett-Packard HP-5244L	Frequency measurement	2.0, 3.6, 7.2, 8.0, 14.4, 16.0, and 28.8 mc.

SECTION 2

INSTALLATION

2-1. UNPACKING AND HANDLING.

No special precautions are required for unpacking and handling the signal generator. Standard procedures are adequate.

2-2. POWER REQUIREMENTS

The signal generator requires a 115-volt ±10%, 60 cps ±5% or 400 cps ±10%, single-phase power source for operation. Power consumption is 10 watts.

2-3. SITE SELECTION.

The signal generator can be placed in any suitable working area where normal lighting and ventilation are present. It is designed for mounting in a 19 - inch rack (figure 2-1) and can also be used in its combination carrying case. The equipment should be situated so that front panel controls are readily accessible for frequent adjustment during operation.

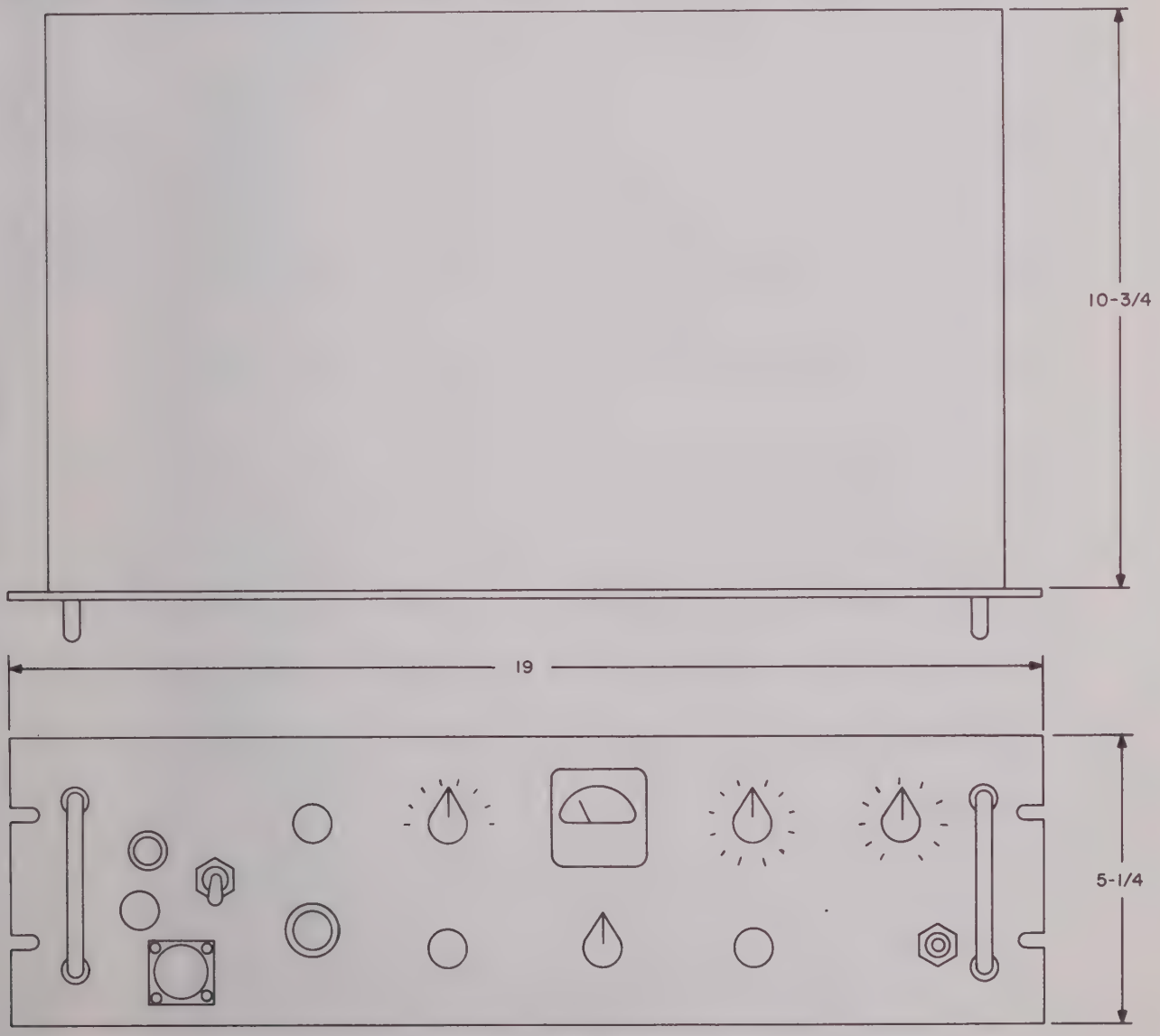


Figure 2-1. Signal Generator SG-823/URM-144, Outline Drawing

2-4. INSPECTION AND ADJUSTMENT.

a. Check the fuse and the mechanical operation of controls according to the procedure given below. Failure of any control to operate properly over its entire range is sufficient cause for failure of the signal generator to pass this test.

(1) Remove the fuse holder cover and visually inspect the fuse. Check that fuse rating is 1/4 ampere and that fuse is not open. Replace fuse and cap.

(2) Operate the following controls and switches several times to all positions.

(a) POWER ON/OFF switch
(b) CENTER FREQUENCY control
(c) FREQUENCY selector switch
(d) ATTENUATOR selector switches (2)
(e) OUTPUT SELECTOR selector switch
(f) TONE A and TONE B LEVEL controls (2)
(g) FINE and COARSE TONE SPACING control

(3) Check that all plug-in parts are securely seated in their sockets.

b. Check the electrical operation of the signal generator as follows:

(1) Connect the power cable to the power source.

(2) Set POWER switch to ON position and check that power indicator 1A1DS1 is lit.

(3) Set OUTPUT SELECTOR switch to TONE A and vary TONE A LEVEL control. Front panel meter will vary accordingly.

(4) Set OUTPUT SELECTOR switch to TONE B and vary TONE B LEVEL control. Front panel meter will vary accordingly.

(5) Set OUTPUT SELECTOR switch to A+B and vary TONE A LEVEL control and TONE B LEVEL control. Front panel meter will vary accordingly.

(6) To perform a complete operational check of the signal generator, refer to section 3.

SECTION 3

OPERATION

-1. FUNCTIONAL OPERATION.

Signal Generator SG-823/URM-144 generates a pair of equal amplitude sine wave rf signals separated by an adjustable audio frequency difference. The signals can be added without appreciable distortion. The signal generator is used to measure receiver sensitivity and distortion in SSB transmitters and receivers. It is suitable for testing SSB communications equipment in both ship and shore installations.

3-2. PREPARATION FOR USE.

After installing the signal generator check its electrical operation by performing the procedures given in paragraph 2-4b.

3-3. OPERATION PROCEDURES.

a. DESCRIPTION OF CONTROLS. The operating controls and indicators and their function are given in table 3-1. The location of the controls and indicators are shown in figure 3-1.

TABLE 3-1. OPERATING CONTROLS AND INDICATORS

FIGURE 3-1 INDEX NO.	CONTROL OR INDICATOR	REFERENCE DESIGNATION	FUNCTION
1	Power On Indicator	1A1DS1	Lights when ac power has been supplied
2	Power ON/OFF Switch	1A1S1	Energizes and deenergizes signal generator
3	CENTER FREQUENCY Control	1A2A3-L1, L2 and 1A2A4-L1, L2	Adjusts frequencies of both crystal oscillators simultaneously
4	FREQUENCY Selector Switch	1A2A3S1, 1A2A4S1	Selects signal generator output frequency
5	Meter	1A1M1	Indicates signal generator relative output level
6	ATTENUATOR DB	1A1A2	Attenuates output signal level in 10 dBm increments
7	ATTENUATOR DB	1A1A1	Attenuates output signal level in 1 dBm increments
8	OUTPUT 50 OHM	1A1J2	Signal output jack
9	TONE B LEVEL Control	1A1R1	Adjusts tone B oscillator output level
10	OUTPUT SELECTOR Selector Switch	1A1S2	Selects tone A, tone B, or tone A and B oscillator output
11	TONE A LEVEL Control	1A1R2	Adjusts tone A oscillator output level
12	FINE/COARSE TONE SPACING Concentric Control	1A2A3C10	Adjusts frequency of tone B oscillator
13	Input Power Connector	1A1J1	Power Input jack
14	Fuse	1A1F1	Provides overload protection for the signal generator

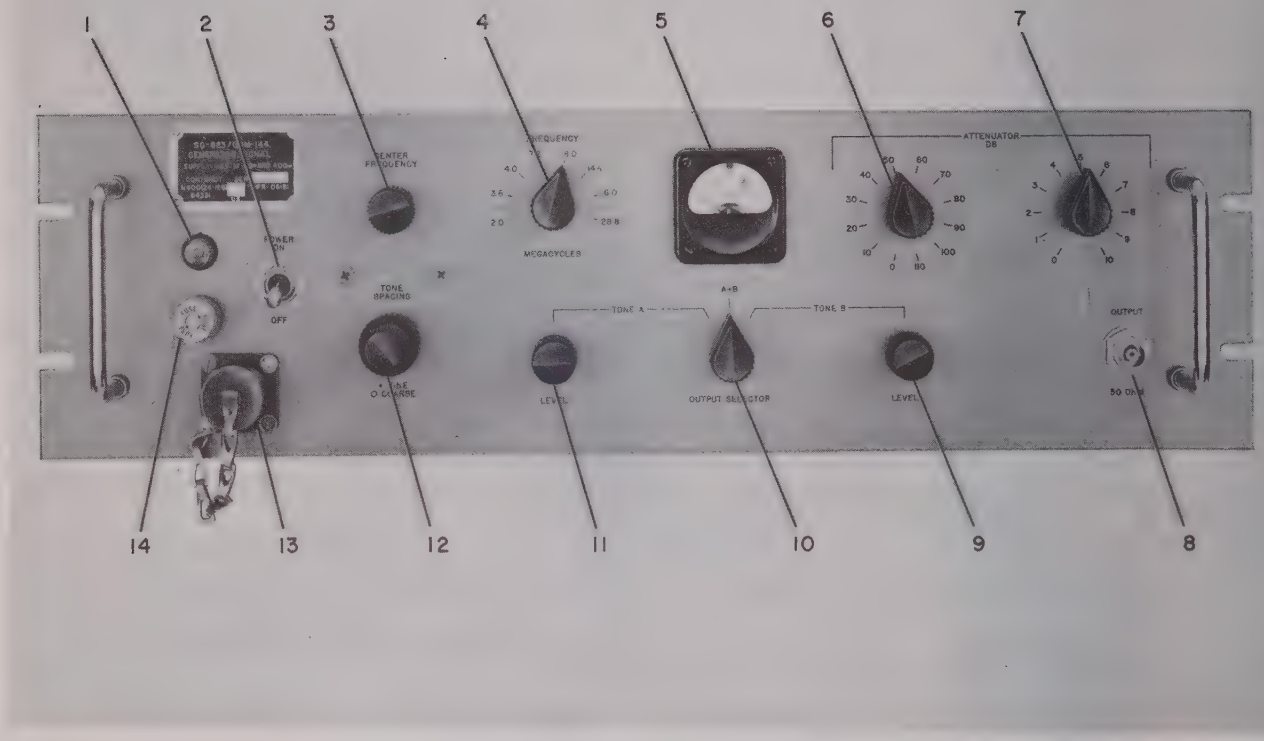


Figure 3-1. Signal Generator SG-823/URM-144, Operating Controls and Indicators

b. SEQUENCE OF OPERATION.

(1) BEFORE USE. Before using the signal generator, proceed as follows:

(a) Connect the signal generator to a source of 115-volt, 60/400 cycle power.

(b) Set the POWER switch to the ON position.

(c) Allow 15 minutes for warm up.

(2) DURING USE. Periodically check that meter indicates desired output level. Adjust TONE A and TONE B LEVEL controls as necessary.

(3) AFTER USE. If the signal generator is not to be used for a relatively long period of time (compared to the 15-minute warm up time required) deenergize the unit by setting the POWER switch to OFF. If the signal generator is to be used at varying intervals, it is advisable to maintain the unit energized for frequency stability.

(4) SECURE. In the event of an emergency, deenergize the signal generator by setting the POWER switch to OFF.

3-4. SUMMARY OF OPERATING PROCEDURES.

a. SINGLE-TONE RF SIGNAL. When using either tone A or tone B, perform the following:

(1) Connect output cable from 50 OHM OUTPUT jack to load.

(2) Set OUTPUT SELECTOR switch to TONE A or to TONE B.

(3) Set POWER switch to ON.

(4) Set FREQUENCY selector switch to desired frequency.

(5) Adjust CENTER FREQUENCY control for desired output frequency.

(6) Adjust TONE A LEVEL or TONE B LEVEL controls for desired indication on meter.

(7) Adjust ATTENUATOR switches for desired output level.

b. DUAL-TONE RF SIGNAL. When using tone A+B perform the following:

(1) Connect output cable from 50 OHM OUTPUT jack to load.

(2) Set OUTPUT SELECTOR switch to A+B.

(3) Set POWER switch to ON.

(4) Set FREQUENCY SELECTOR switch to desired frequency.

(5) Adjust CENTER FREQUENCY control for desired output frequency.

(6) Adjust TONE A LEVEL and TONE B LEVEL controls for equal output levels, as indicated by meter.

(7) Adjust TONE SPACING control for desired frequency difference.

(8) Adjust ATTENUATOR switches for desired output level.

3-5. OPERATOR'S MAINTENANCE.

a. OPERATING CHECKS AND ADJUSTMENTS.

(1) Set the OUTPUT SELECTOR switch to TONE A and the FREQUENCY switch to 2.0 megacycles. Check that the TONE A LEVEL control is capable of being adjusted so that the meter indicates A or B.

(2) Set the OUTPUT SELECTOR switch to TONE B and the FREQUENCY switch to 2.0 megacycles. Adjust and check that the TONE B LEVEL control is capable of being adjusted so that the meter indicates A or B.

(3) Set the Output Selector Switch to A+B. The Meter should increase toward A+B but, not exceed the A+B Zone.

~~(8) Set the OUTPUT SELECTOR switch to A + B. The meter should indicate "A + B".~~

(4) Repeat steps (1), (2) and (3) for each frequency.

b. PREVENTIVE MAINTENANCE.
See Section 5.

c. EMERGENCY MAINTENANCE.

If the signal generator fails to operate and the power on indicator is extinguished, remove and replace 1/4 ampere fuse.

CAUTION

Do not replace with fuse of greater than 1/4 ampere. If the new fuse blows, do not replace. Refer to Section 4.

SECTION 4

TROUBLESHOOTING

4-1. TROUBLESHOOTING.

This section contains troubleshooting information for the signal generator. The following paragraphs consist of a troubleshooting chart, functional and servicing block diagrams, and functional and detailed theory of operation. The troubleshooting chart (table 4-1) lists malfunction symptoms, probable causes, and remedial procedures. The functional block diagram (figure 4-1) illustrates signal flow in the equipment. The servicing block diagram (figure 4-6) indicates nominal operating voltage for the signal generator and facilitates malfunction isolation.

TABLE 4-1. TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	REMEDY
Power on indicator not lighted	a. A-c power not applied	a. Check POWER ON/OFF switch, power cable, and power source
	b. Blown fuse	b. Check fuse and replace if blown CAUTION Do not replace with fuse of higher than 1/4 ampere rating. If fuse burns out immediately after replacement, do not replace a second time until the cause has been determined and the trouble corrected. Remove power from unit and check for a short circuit.
	c. Defective power on indicator lamp	c. Check indicator lamp and replace if defective
Power on indicator lighted but signal generator inoperative	a. Defective power component	a. Check power supply and replace defective component
	b. Defective OUTPUT SELECTOR switch	b. Replace switch
	c. Defective FREQUENCY selector switch	c. Replace switch
Meter indicates signal but no output observed at 50 OHM OUTPUT jack	Defective attenuator or defective output bridge	Replace defective parts as necessary
No tone A output	Defective tone A oscillator or multiplier component	Trace signal path with oscilloscope through tone A oscillator and multiplier to locate defective component. Replace defective component
No tone B output	Defective tone B oscillator or multiplier component	Trace signal path with oscilloscope through tone B oscillator and multiplier to locate defective component. Replace defective component

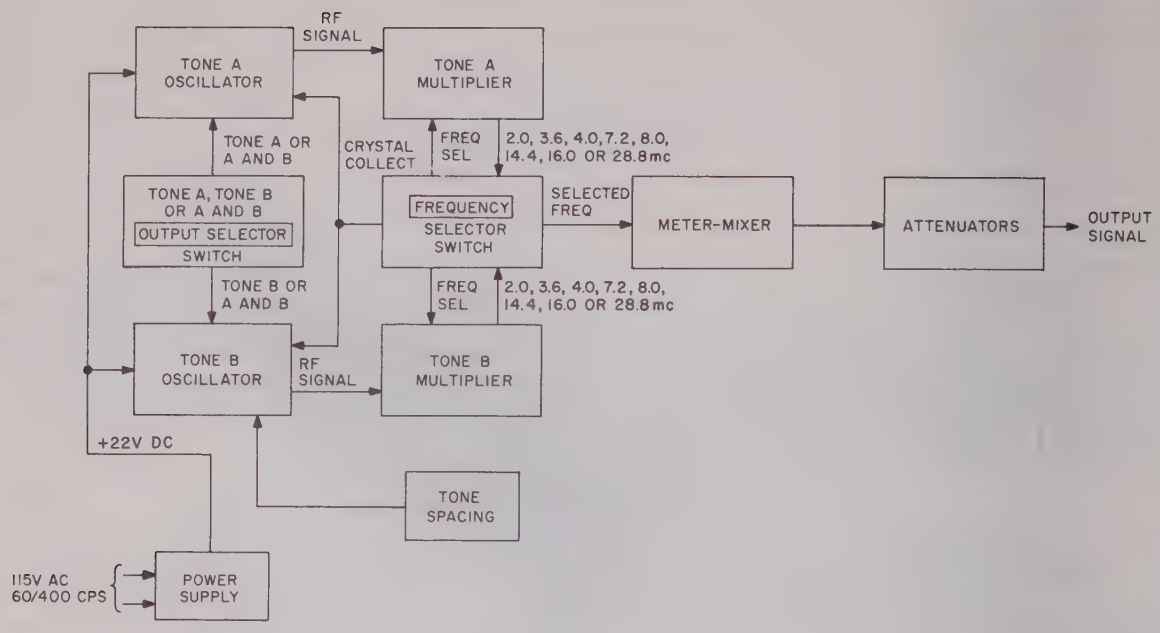


Figure 4-1. Signal Generator SG-823/URM-144, Functional Block Diagram

4-2. OVERALL FUNCTIONAL DESCRIPTION.

The signal generator consists of two crystal controlled rf oscillator-multipliers, a meter-mixer section, an output attenuating network, and a power supply. Each rf oscillator-multiplier contains a 2.0 mc crystal and a 3.6 mc crystal, which are selected alternately by the FREQUENCY selector switch, to produce the desired frequencies. The rf signal produced by each rf oscillator is amplified and applied to the multiplier associated with the oscillator. Each multiplier consists of a buffer amplifier stage and three frequency doubler stages. The FREQUENCY selector switch connects each successive frequency doubler stage in series with the preceding stages, according to the output frequency selected. Available output frequencies of each multiplier, therefore, are one, two, four, and eight times the crystal oscillator output frequency (2.0 mc, 3.6 mc, 4.0 mc, 7.2 mc, 8.0 mc, 14.4 mc, 16.0 mc, and 28.8 mc). The output frequencies of both oscillators can be simultaneously adjusted to the corresponding crystal frequencies. This adjustment is effected by the CENTER FREQUENCY control which varies the inductors in series with each oscillator crystal. The frequency of the tone B oscillator can be further adjusted by means of the TONE SPACING control which varies a capacitance in series with the tone B oscillator crystal. The OUTPUT SELECTOR switch selects either or both rf oscillators by grounding the undesired signal. The selected rf oscillator signals are routed to the corresponding multipliers. The outputs of the multipliers are fed to the meter-mixer section by means of the FREQUENCY selector switch. Signal levels are controlled by the TONE A LEVEL control and the TONE B LEVEL control. The output mixer circuit consists of a transformer and a resistance bridge. The output mixer circuit combines the tone A and tone B oscillator signals in such a way as to minimize intermodulation effects. The output mixer circuit routes the summed tone A and tone B signals to the attenuators. Before mixing and attenuation, the output signal level is monitored by the meter and its associated circuitry. The tone A and tone B rf signals are each coupled to a diode detector followed by an RC filter network. Power for the individual circuits of the signal generator is provided by a regulated 22 volt power supply.

4-3. CIRCUIT DESCRIPTION.

a. RF OSCILLATORS AND MULTIPLIERS.

(1) The two rf oscillators (tone A and tone B) are identical, except for the additional tuning capability of the tone B oscillator. (See figure 4-2.) Both oscillators are two-stage emitter coupled amplifiers with crystal-controlled feedback circuits. The oscillator frequency response is sufficiently flat to allow operation at both 2.0 mc and 3.6 mc. Each oscillator contains both a 2.0 mc crystal and a 3.6 mc crystal, which are alternately selected by the FREQUENCY selector switch to produce the desired frequencies. The frequency of both oscillators may be varied in unison by means of the CENTER FREQUENCY control, which varies the inductances in series with the crystals. In addition, the tone B oscillator frequency may be varied by means of the TONE SPACING control, which varies the capacitance in series with the tone B oscillator crystals. The OUTPUT SELECTOR switch selects either or both crystal oscillator outputs by grounding either or neither signal at the emitters of 1A2A3A1Q2 and 1A2A4A1Q2 (figure 5-1). The output of the crystal oscillator is applied to amplifier Q3 by means of capacitor C4. The resulting signal is applied to the multiplier via coupling capacitor C6.

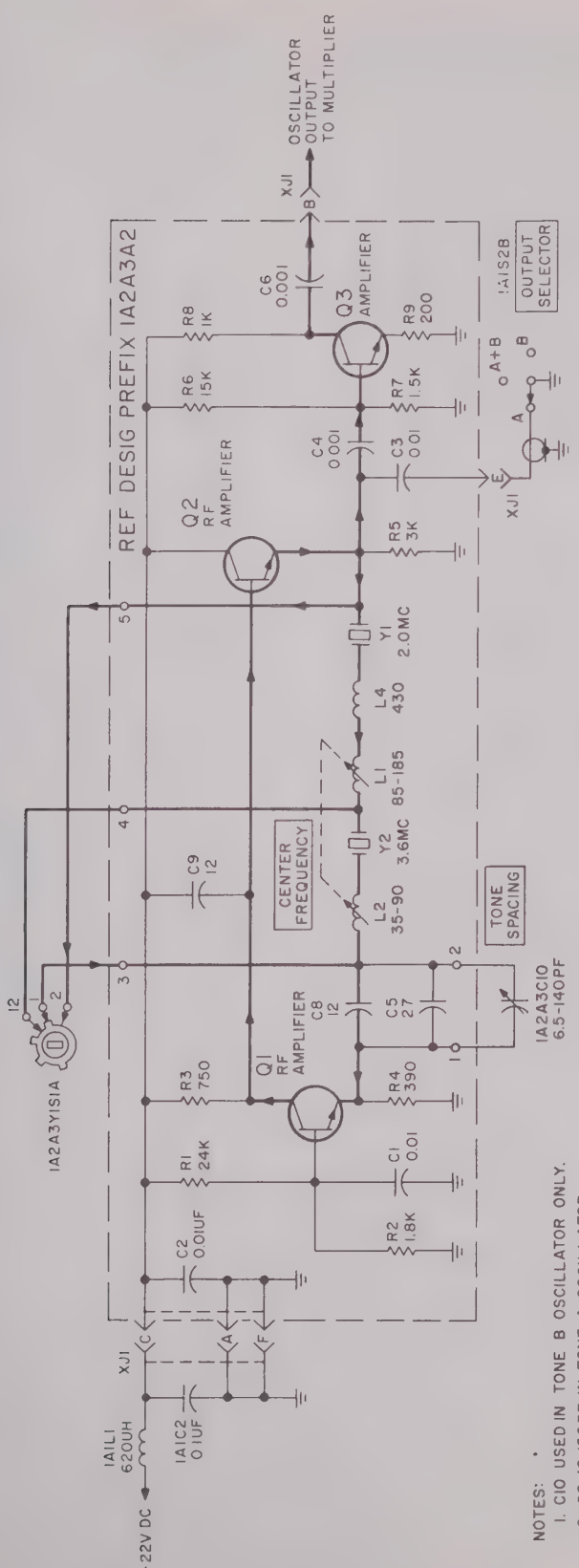


Figure 4-2. Crystal Oscillator, Simplified Schematic Diagram

(2) The multipliers (figure 4-3) consist of buffer amplifier Q1, and frequency doublers Q2, Q3, and Q4. Buffer amplifier Q1 amplifies and isolates the oscillator output signal. The buffer amplifier also serves to restore a sine waveform to the oscillator output signal, which is distorted due to the saturation-point operation of the crystal oscillators. The buffer amplifier Q1 output signal is fed either to the meter-mixer section or to frequency doubler Q2, depending on the position of the FREQUENCY selector switch. In the latter case, the output signal of frequency doubler Q2 (which is now twice the original crystal frequency) is similarly applied either to the meter-mixer section or to frequency doubler Q3, depending on the position of the FREQUENCY selector switch. The output signal of frequency doubler Q3 may then be doubled a third time by means of frequency doubler Q4 or routed to the meter-mixer section. The output signal of frequency doubler Q4 is now eight times the crystal frequency.

b. METER-MIXER SECTION.

(1) The output signals from the two miltipliers are applied to the TONE A and TONE B LEVEL controls potentiometers 1A1R1 and 1A1R2. The tone A oscillator signal is routed from potentiometer 1A1R1 to the R1-R2 junction of output bridge R1-R2-R3. The tone B oscillator signal is routed from potentiometer 1A1R2 to the primary winding of output transformer T1. The secondary winding of output transformer T1 applies the tone B oscillator signal to the R1 and R2-R3 junctions of output bridge R1-R2-R3. The signal generator output appears at the R1 and R3 (ground) junctions of the output bridge. When both tone A and tone B signals are selected, the signal generator output signal consists of the simple sum of the two independent signals, with no intermodulation effects.

(2) The meter circuit consists of diode detectors CR1 and CR2, each followed by an RC filter network. The tone A and tone B oscillator signals appearing at potentiometers 1A1R2 and 1A1R1, respectively, are applied to meter-zero potentiometers R12 and R13. The signals are then detected and filtered. The output of each filter network is applied to output level meter M1.

c. POWER SUPPLY.

The power supply (figure 4-5) consists of power transformer 1A2T1, a full-wave diode rectifier bridge, and a grounded-emitter voltage regulator. The required input power is 115 volts, 60 cycle or 400 cycle a-c. Switch 1A1S1 controls main power application and fuse 1A1F1 provides overload protection. Power transformer 1A2T1 provides a voltage stepdown of 115 to 30 volts. The secondary windings of power transformer 1A2T1 applies 30 volts ac to the full-wave diode rectifier bridge CR1-CR2-CR3-CR4. The negative dc output of the rectifier is applied to the collector of regulator Q1 and to the base of regulator Q1 through resistor R1. The positive dc output of the rectifier is applied to the load. Zener diode CR5 is connected between the base of regulator Q1 and the positive dc output of the rectifier; thereby establishing a reference voltage for the regulator. The output voltage of the power supply is thus maintained at a relatively constant level.

4-4. SERVICING BLOCK DIAGRAM.

Figure 4-6 is a servicing block diagram of the signal generator. The block diagram provides the maintenance technician with a pictorial guide for use in troubleshooting, and indicates the adjustments that can be made on each stage. There are no internal test jacks. Output signal level is indicated by the front panel output signal level meter.

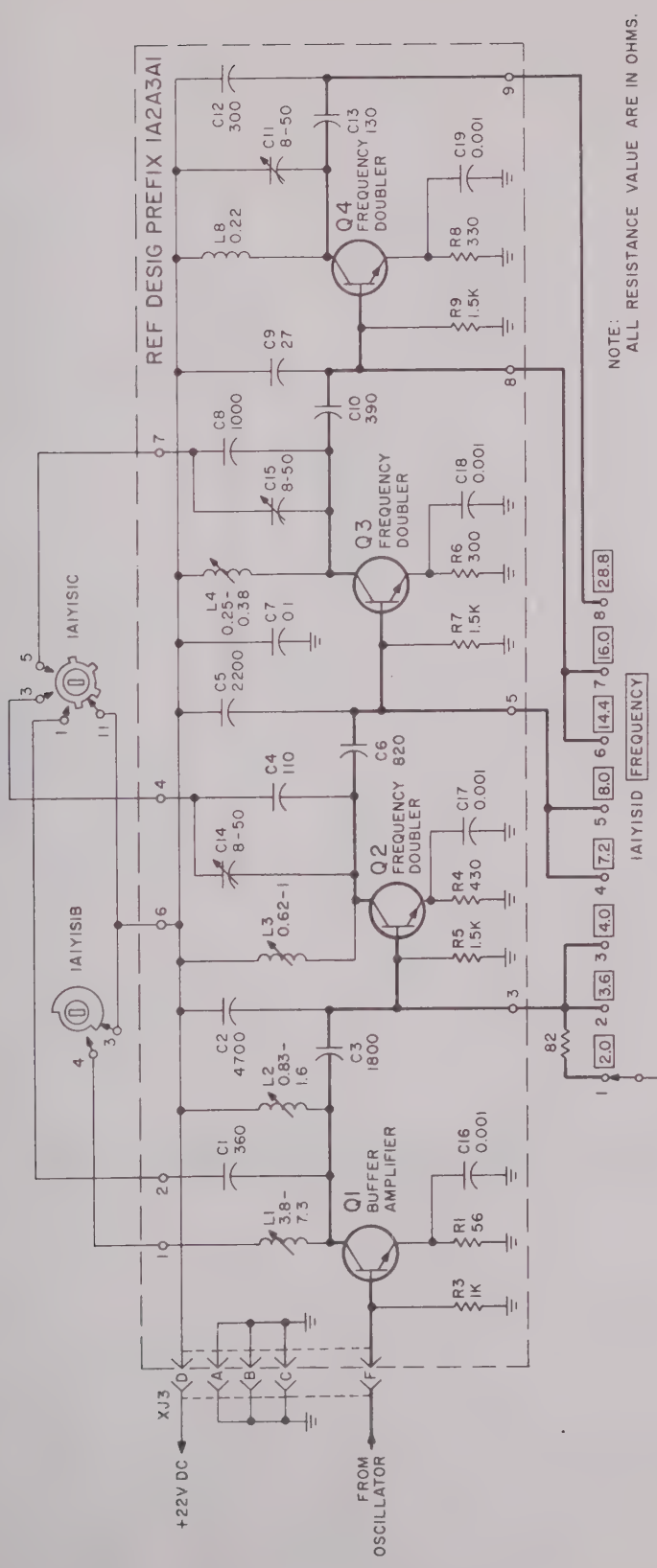


Figure 4-3. Multiplier, Simplified Schematic Diagram

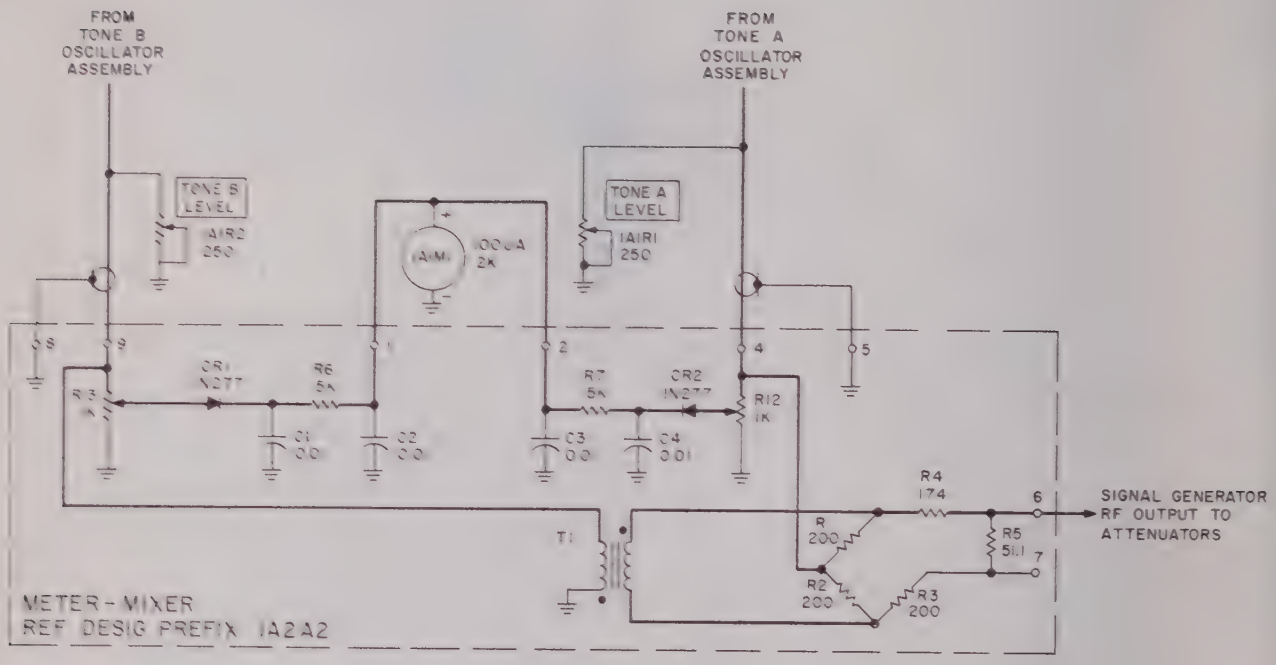


Figure 4-4. Meter-Mixer, Simplified Schematic Diagram

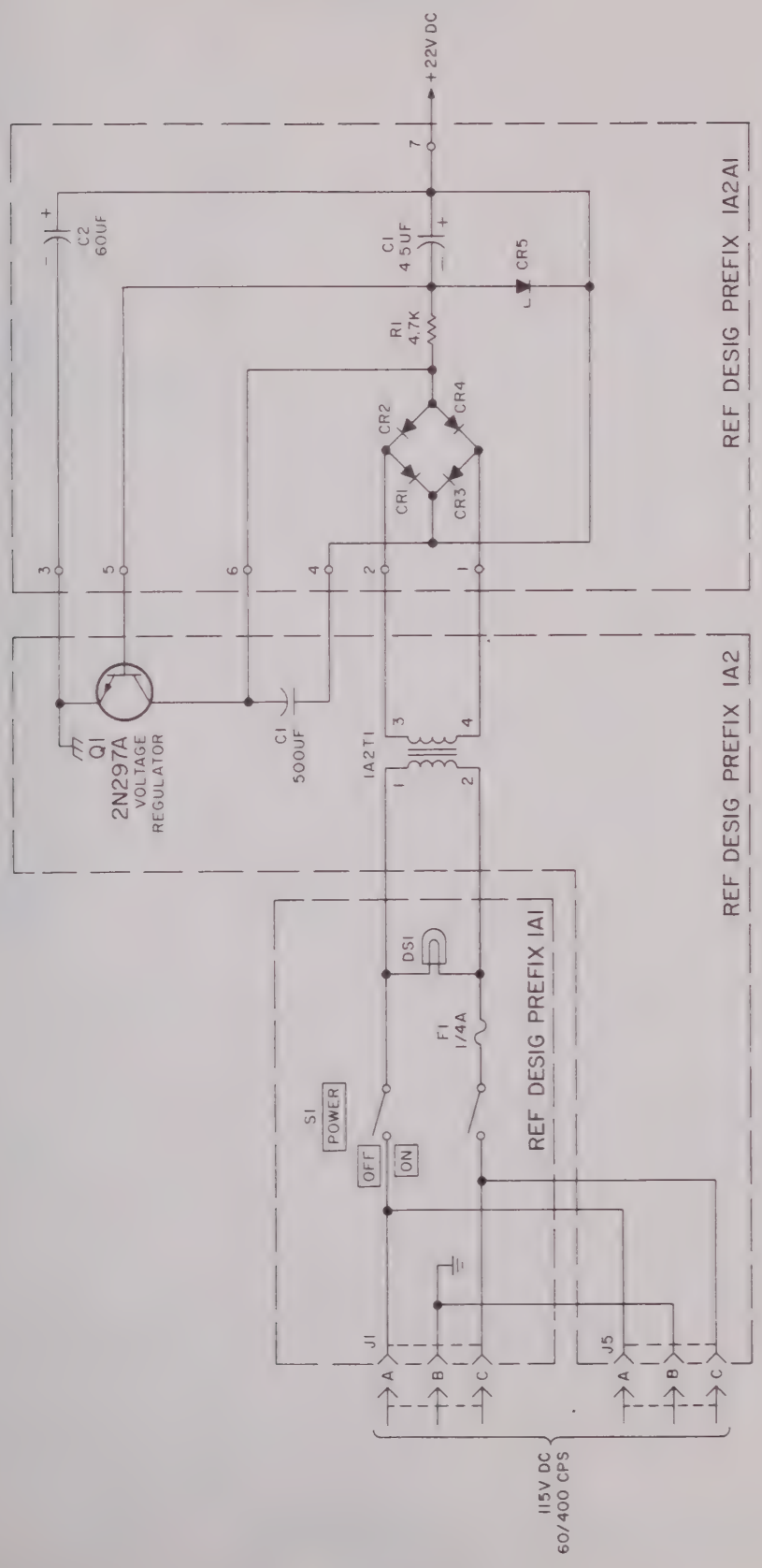


Figure 4-5. Power Supply, Simplified Schematic Diagram

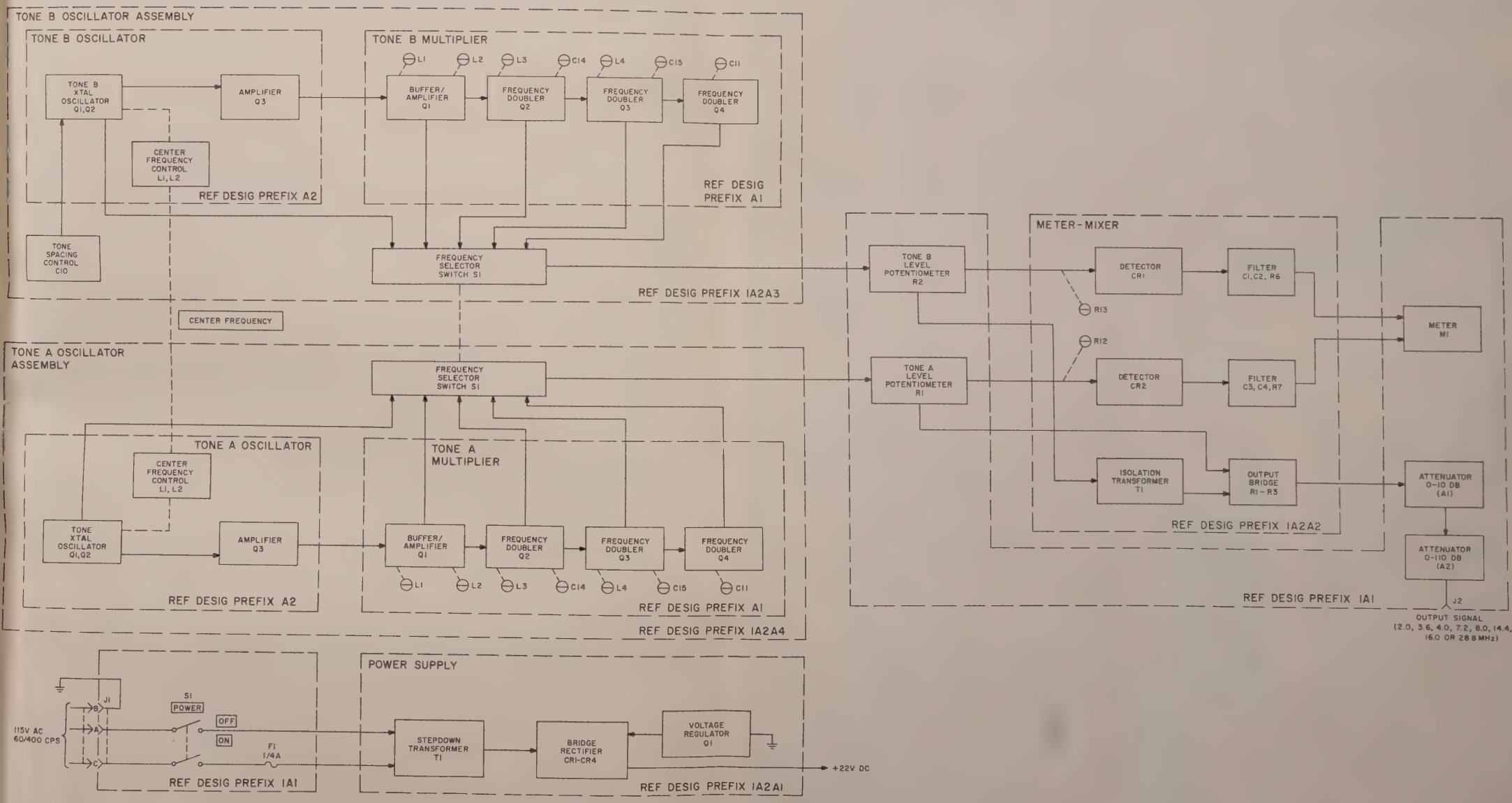


Figure 4-6. Signal Generator SG-823/URM-144, Servicing Block Diagram

SECTION 5

MAINTENANCE

5-1. FAILURE, AND PERFORMANCE AND OPERATIONAL REPORTS.

The Naval Electronic System Command no longer requires the submission of failure reports for all equipments. Failure Reports and Performance and Operational Reports are to be accomplished for designated equipments (refer to Electronics Installation and Maintenance Book, NAVSHIPS 900,000) only to the extent required by existing directives. All failures shall be reported for those equipments requiring the use of Failure Reports.

5-2. PREVENTIVE MAINTENANCE.

a. MAINTENANCE STANDARDS.

(1) TEST EQUIPMENT AND SPECIAL TOOLS. The test equipment required to perform preventive maintenance is listed in table 1-2.

(2) SPECIAL PROCEDURES. There are no special procedures required before performing the preventive maintenance procedures.

(3) REFERENCE STANDARDS PROCEDURES. Table 5-1 lists the reference standards procedures that assure proper operation of the signal generator.

Note

The procedures listed below consist of the minimum number of reference standards which will indicate, when completed, the relative performance of the signal generator. The procedures are listed in the suggested sequence of performance; however, deviation from the listed order will in no way affect the unit or results of the reference standards.

(4) PREVENTIVE MAINTENANCE PROCEDURES. The following preventive maintenance should be performed every 90 days.

(a) Make visual inspection and check mechanical operation of controls, as described in paragraph 2-4.

TABLE 5-1. REFERENCE STANDARDS PROCEDURES

SECTION	ACTION REQUIRED	REFERENCE
Oscillator-Multiplier	Measure frequency at output jack 1A1J2	W1
Meter-Mixer, Power Supply	Check deflection on front panel meter	W2

TABLE 5-2. PREVENTIVE MAINTENANCE PROCEDURES

WHAT TO CHECK	HOW TO CHECK	CORRECT RESULT
Controls and Switches	Operate all controls and switches through all positions	Positive action
Chassis	Remove dust with brush or cloth	
Mechanical	Tighten all loose screws	
Visual	Power transformer for leaks, resistors for discoloration, capacitors for bulging	
RF Output	Observe output meter while operating FREQUENCY selector switch and OUTPUT SELECTOR switch to all positions	Output meter varies only when OUTPUT SELECTOR switch is switched between A & B and A or B

b. TUNING AND ADJUSTMENT.

(1) OUTPUT SIGNAL ACCURACY. - Repair or replacement of components on Multiplier Board Assembly 1A2A3A1 or 1A2A4A1 might necessitate the readjustment of trimmer capacitors and/or coils located on the multiplier board. After all repairs are completed, check the signal generator output at the front panel OUTPUT jack. Check the output at all frequency settings of the FREQUENCY selector switch (2.0 mc, 3.6 mc, 4.0 mc, 7.2 mc, 8.0 mc, 14.4 mc, 16.0 mc and 28.8 mc). When readjustment is necessary the trimmer capacitor in the collector circuit of transistor providing the specific errant frequency output should be adjusted. If further adjustment is necessary, adjust the trimmer capacitor in the preceding stage. Check signal generator output at all settings of the FREQUENCY selector switch after completion of final adjustment. Check frequency at OUTPUT jack of signal generator at all FREQUENCY selector switch settings after repairing or replacing oscillator assembly 1A2A3A2 or 1A2A4A2. Adjust trimmer capacitor and coils as necessary.

(2) CENTER FREQUENCY ADJUSTMENT. - Adjustment of the CENTER FREQUENCY control shaft connecting L1 and L2 of oscillator assembly 1A2A3A2 to L1 and L2 of oscillator assembly 1A2A3A2 is necessary when the shaft is decoupled to facilitate repair or replacement of the oscillator assemblies. Do not tighten the shaft coupling collar after reassembling oscillator assemblies. Set the FREQUENCY selector switch to 2.0 mc and measure frequency output at the OUTPUT jack. Rotate shaft on either side of the coupling to achieve the same frequency shift; then tighten collar. After coupling collar is tightened, rotate the CENTER FREQUENCY control through its entire range; check that output frequency of both oscillators shift in unison.

5-3. REPAIR AND REPLACEMENT.

a. REMOVAL, REPAIR AND REPLACEMENT OF PARTS, SUBASSEMBLIES AND UNITS. The location of components is shown in figures 5-2 through 5-5. No special methods of procedure are required for removal, repair and replacement of parts.

b. EMERGENCY MAINTENANCE FOR ELECTRONIC ASSEMBLIES. Not applicable.

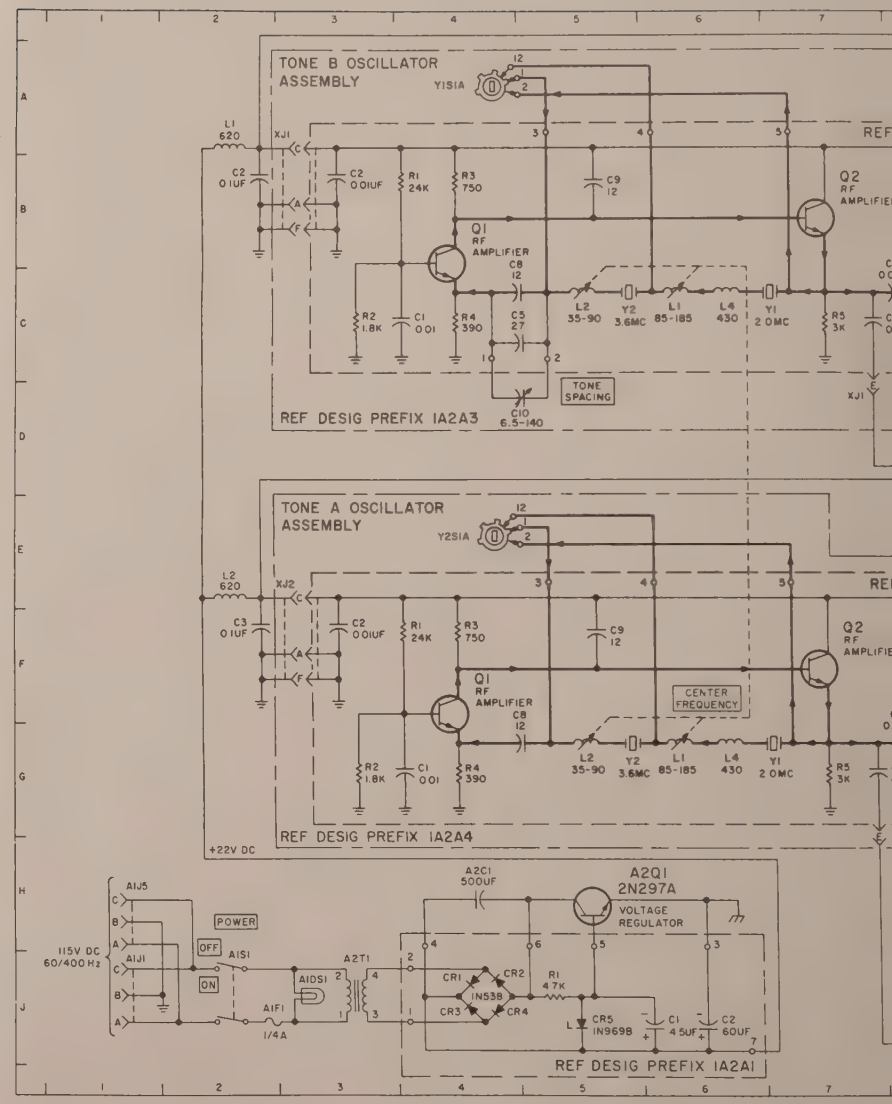
5-4. ILLUSTRATIONS.

a. OVERALL SCHEMATIC DIAGRAM. Figure 5-1 is schematic diagram of the equipment. The major signal parts are indicated by heavy lines and the direction of signal flow by arrows.

b. PART LOCATION. Figures 5-2 through 5-5 locate the components of the signal generator.

Legend for Figure 5 - 1

REF DESIG	LOCATION
C2	B2
C3	F2
L1	A2
L2	E2
A1DS1	J3
A1F1	J2
A1J1-A	J1
A1J1-B	J1
A1J1-C	J1
A1J2	H29
A1J5-A	H1
A1J5-B	H1
A1J5-C	H1
A1S1	J2
A1S2A	J8
A1S2B	J8
A2C1	H4
A2Q1	H5
A2T1	J3
1A1M1	G21
1A1P1	H27
1A1P2	H26
1A1R1	G22
1A1R2	G20
1A1W3	H27
1A2P3	H25
1A3J2	J29
1A3R1	J28
1A3P	J27
1A1A1J1	H25
1A1A1J2	H26
1A1A2J1	H27
1A1A2J2	H28
1A2A1CR1	J4
1A2A1CR2	J4
1A2A1CR3	J4
1A2A1CR4	J4
1A2A1CR5	J5
1A2A1C1	J6
1A2A1C2	J6
1A2A1R1	J5
1A2A2C1	H20
1A2A2C2	H21
1A2A2C3	H22
1A2A2C4	H22
1A2A2CR1	H20
1A2A2CR2	H22
1A2A2R1	J23
1A2A2R2	J23
1A2A2R3	J24
1A2A2R4	H24
1A2A2R5	J25
1A2A2R6	H20
1A2A2R7	H22
1A2A2R12	H23
1A2A2R13	H19
1A2A2T1	J22
1A2A3C10	D4
1A2A3XJ1-A	B3
1A2A3XJ1-B	B9
1A2A3XJ1-C	A3
1A2A3XJ1-E	D7
1A2A3XJ1-F	B3
1A2A3XJ3-A	B10
1A2A3XJ3-B	B10
1A2A3XJ3-C	B10
1A2A3XJ3-D	B10
1A2A3XJ3-F	C10
1A2A3Y1S1A	A4
1A2A3Y1S1B	A12
1A2A3Y1S1C	A14
1A2A3Y1S1D	D13
1A2A3A1C1	B11
1A2A3A1C2	B12
1A2A3A1C3	B12
1A2A3A1C4	B13
1A2A3A1C5	B14
1A2A3A1C6	C14
1A2A3A1C7	B14
1A2A3A1C8	C15
1A2A3A1C9	B16
1A2A3A1C10	B16
1A2A3A1C11	B17
1A2A3A1C12	B17
1A2A3A1C13	C17
1A2A3A1C14	B13
1A2A3A1C15	B15
1A2A3A1C16	C11
1A2A3A1C17	C13
1A2A3A1C18	C15
1A2A3A1C19	C17
1A2A3A1L1	B11
1A2A3A1L2	B12
1A2A3A1L3	B13
1A2A3A1L4	B15
1A2A3A1L8	B16
1A2A3A1Q1	C11
1A2A3A1Q2	C13
1A2A3A1Q3	C15
1A2A3A1Q4	C16
1A2A3A1R1	C11
1A2A3A1R3	C11
1A2A3A1R4	C13
1A2A3A1R5	C12
1A2A3A1R6	C15
1A2A3A1R7	C14
1A2A3A1R8	C16
1A2A3A1R9	C16
1A2A3A2C1	C4
1A2A3A2C2	B3
1A2A3A2C3	C7
1A2A3A2C4	C8
1A2A3A2C5	C4
1A2A3A2C6	B8
1A2A3A2C8	C4
1A2A3A2C9	B5
1A2A3A2L1	C6
1A2A3A2L2	C5
1A2A3A2L4	C6
1A2A3A2Q1	B4
1A2A3A2Q2	B7
1A2A3A2Q3	C8
1A2A3A2R1	B4
1A2A3A2R2	C3
1A2A3A2R3	B4
1A2A3A2R4	C4
1A2A3A2R5	C7
1A2A3A2R6	B8
1A2A3A2R7	C8
1A2A3A2R8	B8
1A2A3A2R9	C8
1A2A3A2Y1	C7
1A2A3A2Y2	C5
1A2A4XJ2-A	F3
1A2A4XJ2-B	F9
1A2A4XJ2-C	E3
1A2A4XJ2-E	H7
1A2A4XJ2-F	F3
1A2A4XJ4-A	F10
1A2A4XJ4-B	G10
1A2A4XJ4-C	G10
1A2A4XJ4-D	F10
1A2A4XJ4-F	G10
1A2A4Y2S1A	E4
1A2A4Y2S1B	F12
1A2A4Y2S1C	F14
1A2A4Y2S1D	J13
1A2A4A1C1	G11
1A2A4A1C2	G12
1A2A4A1C3	G12
1A2A4A1C4	G13
1A2A4A1C5	G14
1A2A4A1C6	G14
1A2A4A1C7	G14
1A2A4A1C8	G15
1A2A4A1C9	G16
1A2A4A1C10	G16
1A2A4A1C11	G17
1A2A4A1C12	G17
1A2A4A1C13	H17
1A2A4A1C14	G13
1A2A4A1C15	G15
1A2A4A1C16	H11
1A2A4A1C17	H13
1A2A4A1C18	H15
1A2A4A1C19	H17
1A2A4A1L1	G11
1A2A4A1L2	G12
1A2A4A1L3	G13
1A2A4A1L4	G15
1A2A4A1L8	G16
1A2A4A1Q1	H11
1A2A4A1Q2	H13
1A2A4A1Q3	H15
1A2A4A1Q4	H16
1A2A4A1R1	H11
1A2A4A1R3	H11
1A2A4A1R4	H13
1A2A4A1R5	H12
1A2A4A1R6	H15
1A2A4A1R7	H14
1A2A4A1R8	H16
1A2A4A1R9	H16
1A2A4A2C1	G4
1A2A4A2C2	F3
1A2A4A2C3	G7
1A2A4A2C4	G8
1A2A4A2C6	F8
1A2A4A2C8	G4
1A2A4A2C9	F5
1A2A4A2L1	G6
1A2A4A2L2	G5
1A2A4A2L4	G6
1A2A4A2Q1	F4
1A2A4A2Q2	F7
1A2A4A2Q3	G8
1A2A4A2R1	F4
1A2A4A2R2	G3
1A2A4A2R3	F4
1A2A4A2R4	G4
1A2A4A2R5	G7
1A2A4A2R6	F8
1A2A4A2R7	G8
1A2A4A2R8	F8
1A2A4A2R9	G8
1A2A4A2Y1	G7
1A2A4A2Y2	G5



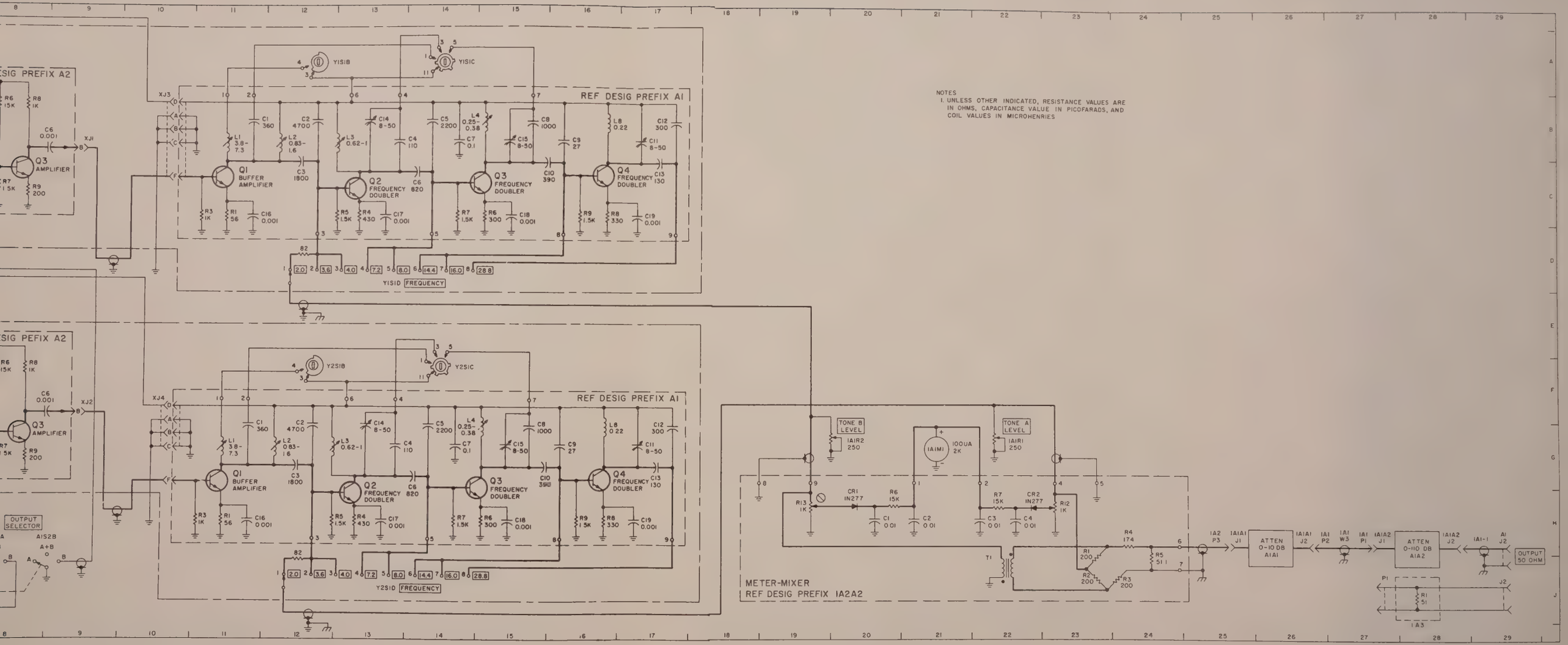


Figure 5-1. Signal Generator SG-823/URM-144, Schematic Diagram

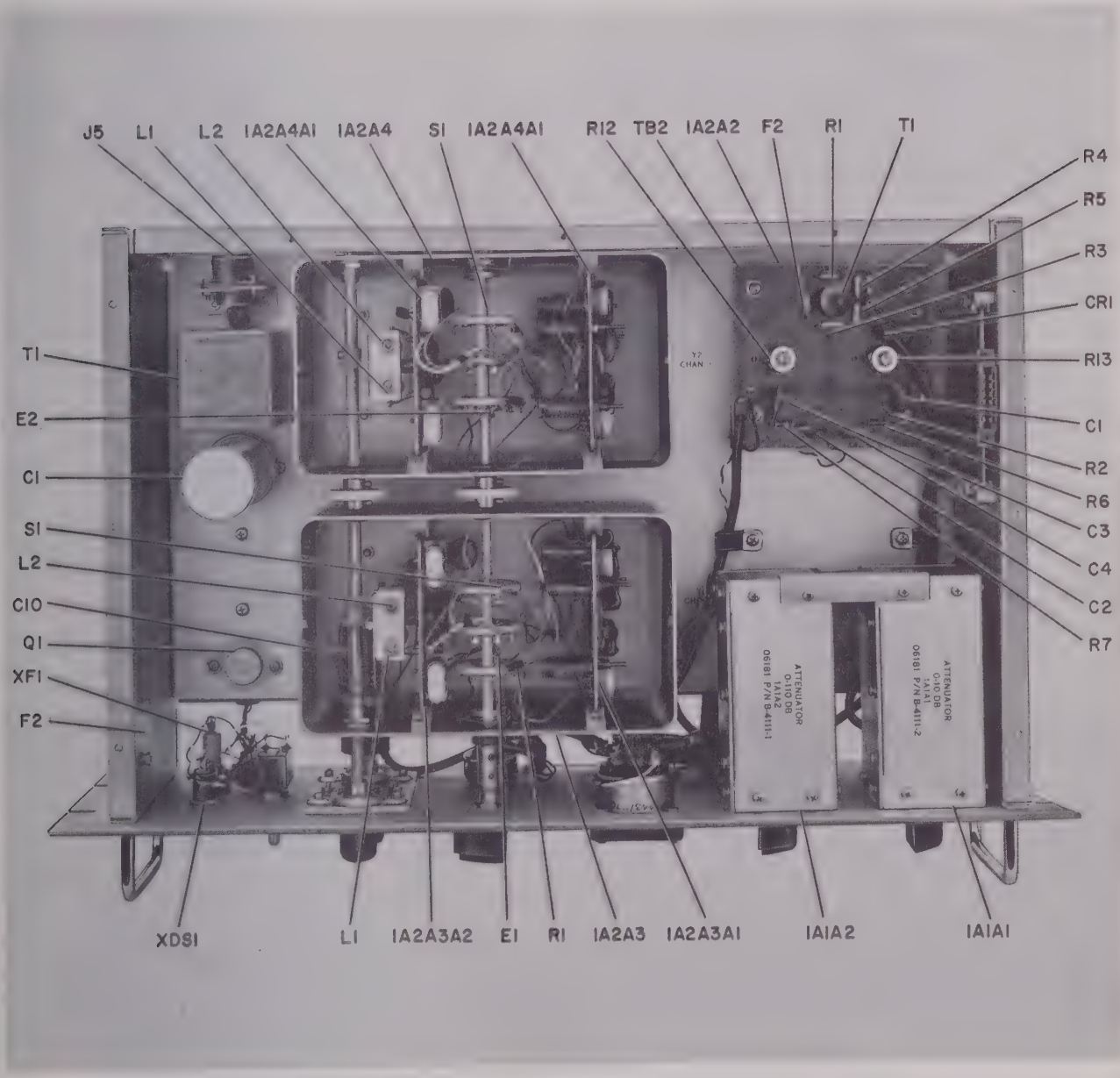


Figure 5-2. Signal Generator SG-823/URM-144, Top View

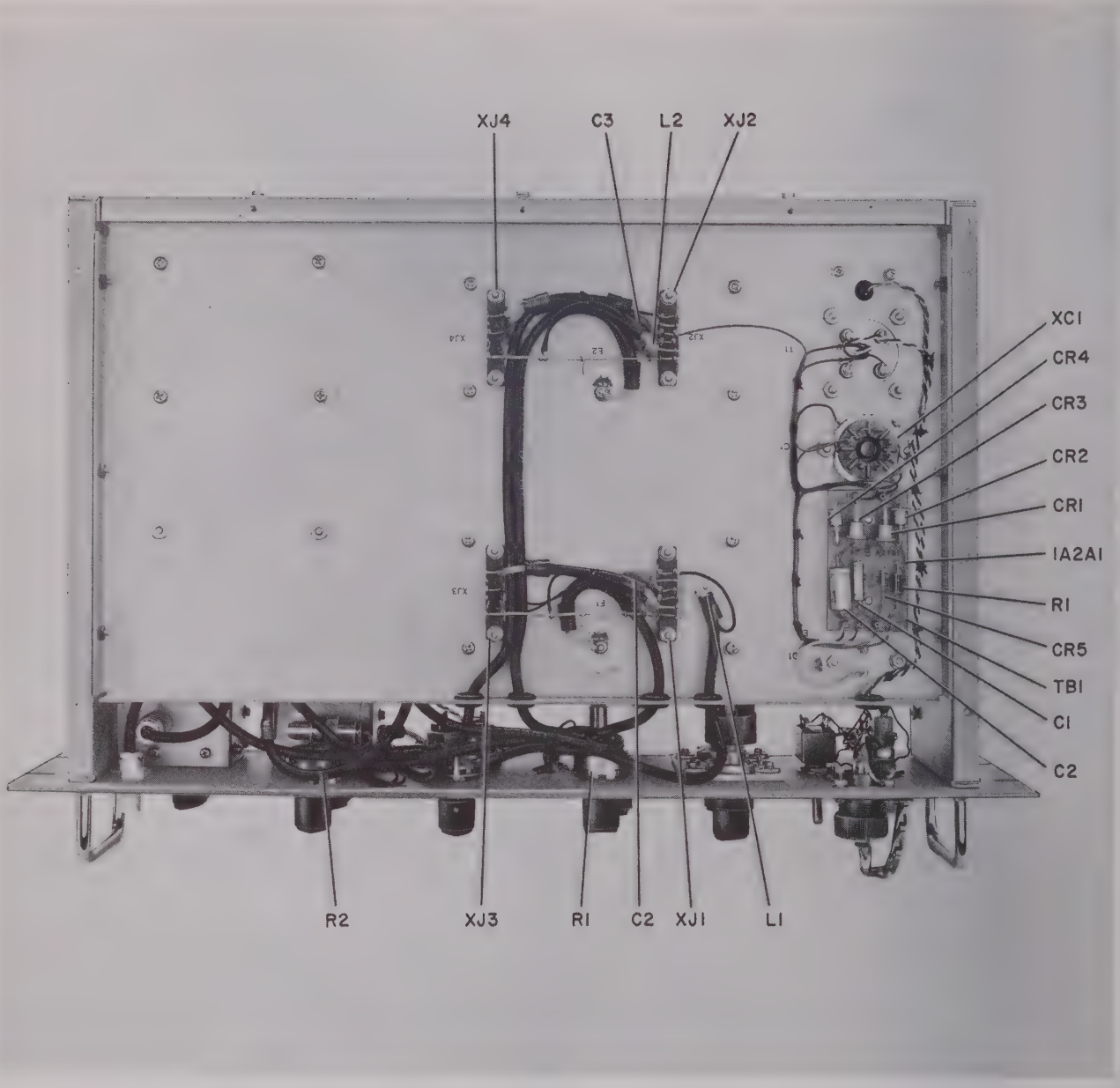


Figure 5-3. Signal Generator SG-823/URM-144, Bottom View

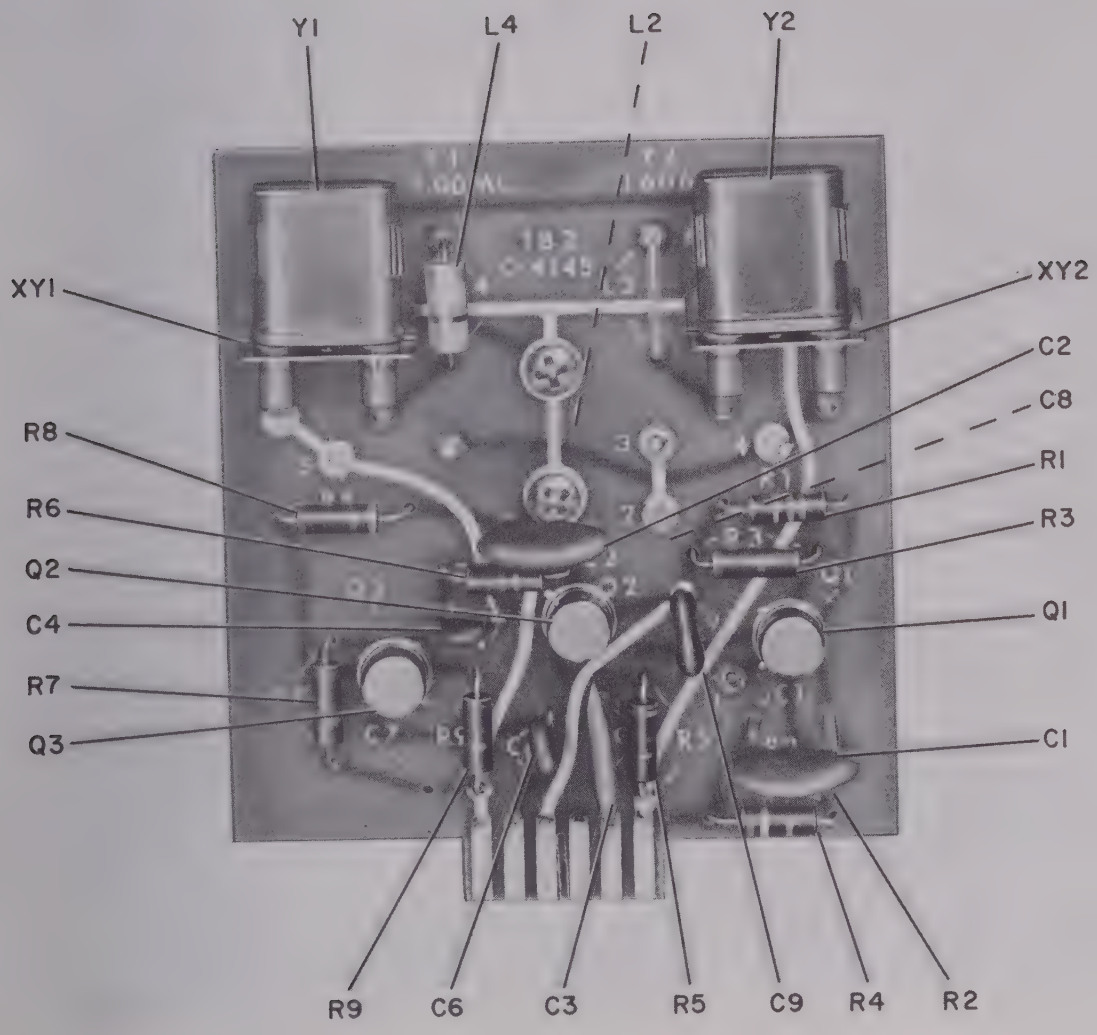


Figure 5-4. Oscillator Board Assembly (1A2A3A2, 1A2A4A2), Location of Components

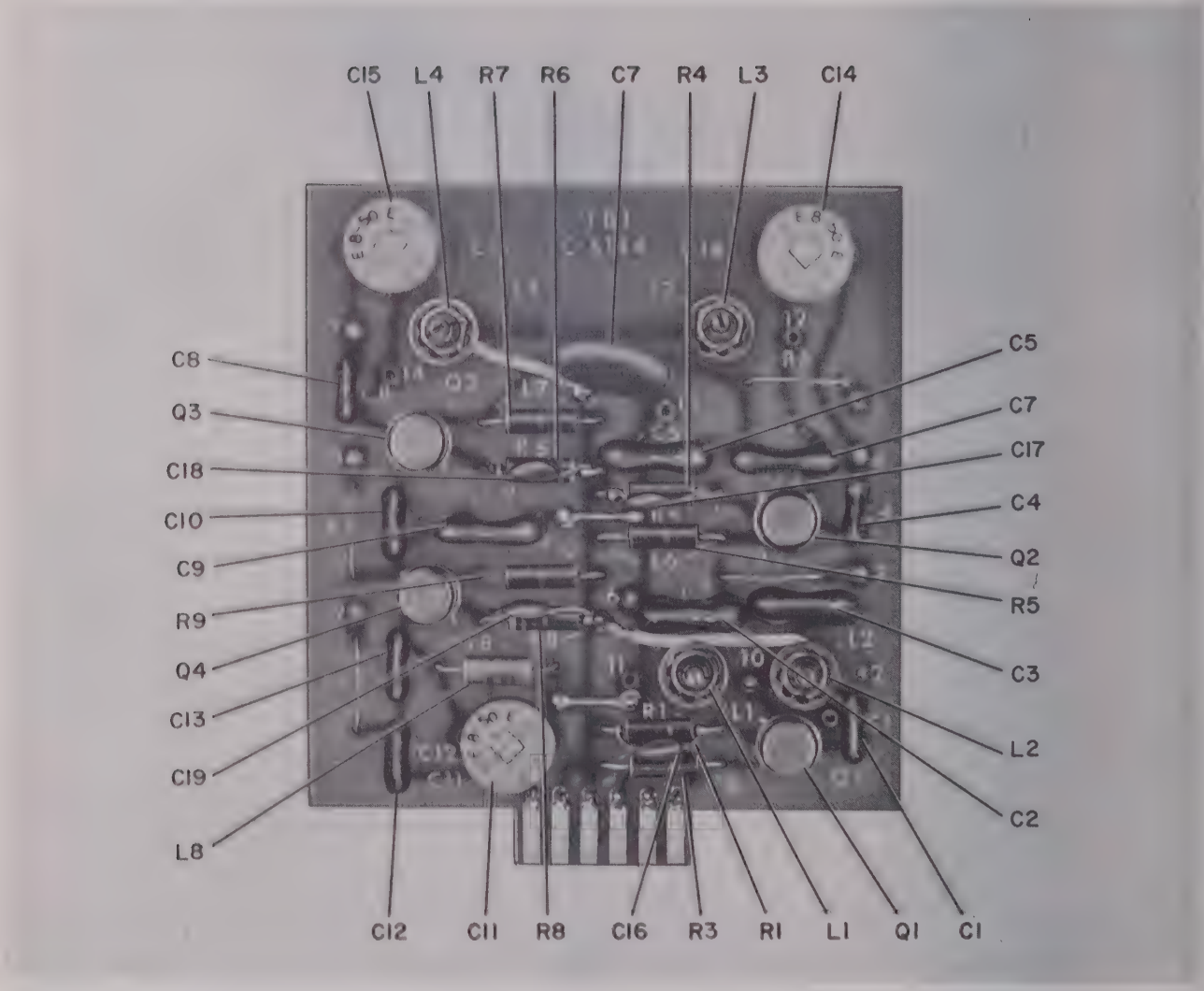


Figure 5-5. Multiplier Board Assembly (1A2A3A1, 1A2A4A1), Location of Components

SECTION 6

PARTS LIST

6-1. INTRODUCTION.

a. REFERENCE DESIGNATION. The unit numbering method of assigning reference designations has been used to identify units, assemblies, subassemblies, and parts. This method has been expanded as much as necessary to adequately cover the various degrees of subdivisions of the equipment. Examples of this unit numbering method and typical expansions of the same illustrated by the following:

Example 1:

1 A1 R1

Unit No.	Subassembly Designation	Class and No. of Item

Read as: First(1) resistor(R) of first(1) subassembly(A) of first(1) unit.

Example 2:

1 A1 A2 R1

Unit No.	Subassembly Designation	Subassembly Designation	Class and No. of Item

Read as: First(1) resistor(R) of second(2) subassembly(A) of first(1) subassembly(A) of first(1) unit.

b. REF. DESIG. PREFIX. Partial reference designations are used on the equipment and illustrations. The partial reference designations consist of the class letter(s) and the identifying item number. The complete reference designations may be obtained by placing the proper prefix before the partial reference designations. Prefixes are provided on illustrations following the notation "REF DESIG PREFIX".

6-2. MAINTENANCE PARTS LIST.

Table 6-1 lists all the maintenance parts for the Signal Generator, SG-823/URM-144. Maintenance parts are listed in alpha-numerical order according to their unit and subassembly designation; and then in alpha-numerical order according to their class and item number. Thus the parts for each unit and subassembly are grouped together. Table 6-1 contains the following information: (1) the complete reference designation of each unit, assembly, subassembly, or part (2) reference to explanatory note that may be used (3) noun name and brief description, and (4) identification of the illustration which pictorially locates the part.

Printed circuit boards, assembly boards, modules, etc., are listed first as individual items in the maintenance parts list. In addition, at the completion of a parts listing for each unit, the individual circuit board, assembly board, module, etc., is then broken down by components into separate part listings. When there is a redundancy of such electronic assemblies in subsequent units, reference is made to the parts breakdown previously listed.

6-3. LIST OF MANUFACTURERS.

Table 6-2 lists the manufacturers of parts used in the SG-823/URM-144 Signal Generator. The table includes the manufacturer's code used in table 6-1 to identify the manufacturers.

TABLE 6-1. MAINTENANCE PARTS LIST

PANEL ASSEMBLY NO. D4105 UD1A1

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
A1		ATTENUATOR: 06181 No. D4111-2	5-3
A2		ATTENUATOR: 06181 No. D4111-1	5-3
DS1		LAMP: 96906 No. MS25252-NE2D	3-1
F1		FUSE: 75915 No. 313.250	3-1
J1		CONNECTOR: 96906 No. MS3102R14S7P	3-1
M1		METER: 06181 No. B4115	3-1
R1		RESISTOR: 81349 No. RV4NAXSA251A	5-3
R2		SAME AS R1	5-3
S1		SWITCH: 96906 No. MS25100-22	3-1
S2		SWITCH, ROTARY: 06181 No. B4101	3-1
XDS1		LAMP ASSY: 96906 No. MS25257-6	5-2
XF1		FUSEHOLDER: 81349 No. FHN26G	5-2

CHASSIS ASSEMBLY NO. D4100 UD1A2

A1		POWER SUPPLY BOARD ASSY: 06181 No. B4153	5-3
A2		METER BOARD ASSY: 06181 No. C4154	5-2
A3		OSCILLATOR ASSY: 06181 No. C4155-1	5-2
A4		OSCILLATOR ASSY: 06181 No. C4155-2	5-2
C1		CAPACITOR: 81349 No. CE51E501G	5-2
C2		CAPACITOR, FIXED: 56289 No. TG P10	5-3
C3		SAME AS C2	5-3
F2		FUSE: 75915 No. 313.250	5-2
J1		CONNECTOR: 96906 No. MS21097/1-019	5-3
J2		SAME AS J1	5-3
J3		SAME AS J1	5-3
J4		SAME AS J1	5-3
J5		CONNECTOR: 96906 No. MS3102R14S7P	5-2
L1		INDUCTOR: 81349 No. LT10K031	5-3
L2		SAME AS L1	5-3
Q1		TRANSISTOR: 81349 No. 2N297A	5-2
T1		TRANSFORMER: 06181 No. B1419B	5-2
XC1		SOCKET: 81349 No. TS101P02	5-3

POWER SUPPLY BOARD ASSEMBLY NO. B4153 UD1A2A1

CR1		SEMICONDUCTOR DEVICE: 81349 No. 1N538	5-3
CR2		SAME AS CR1	5-3
CR3		SAME AS CR1	5-3
CR4		SAME AS CR1	5-3
CR5		SEMICONDUCTOR DEVICE: 81349 No. 1N969	5-3
C2		CAPACITOR: 81349 No. CL25BJ4R5TP3	5-3
C3		CAPACITOR: 81349 No. CL65CJ600MP3	5-3
R1		RESISTOR: 81349 No. RC20GF472J	5-3
TB1		PRINTED CIRCUIT BOARD: 06181 No. B4151-3	5-3

TABLE 6-1. (Continued)

METER BOARD ASSEMBLY NO. C4154 UD1A2A2

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
CR1		SEMICONDUCTOR DEVICE, DIODE: 81349 No. 1N277	5-2
CR2		SAME AS CR1	5-2
C1		CAPACITOR: 81349 No. CK63AW103M	5-2
C2		SAME AS C1	5-2
C3		SAME AS C1	5-2
C4		SAME AS C1	5-2
R1		RESISTOR: 81349 No. RN60D2000F	5-2
R2		SAME AS R1	5-2
R3		SAME AS R1	5-2
R4		RESISTOR: 81349 No. RN60D1740F	5-2
R5		RESISTOR: 81349 No. RN60D51R1F	5-2
R6		RESISTOR: 81349 No. RC20GF153J	5-2
R7		SAME AS R6	5-2
R12		RESISTOR: 81349 No. RV4LAYSA102A	5-2
R13		SAME AS R12	5-2
TB2		PRINTED CIRCUIT BOARD: 06181 No. C4143	5-2
T1		TRANSFORMER: 06181 No. B4110	5-2

OSCILLATOR ASSEMBLY NO. C4155-1 UD1A2A3

A1		MULTIPLIER BOARD ASSEMBLY: 06181 No. C4156	5-2
A2		OSCILLATOR BOARD ASSEMBLY: 06181 No. C4157	5-2
C10		CAPACITOR, VARIABLE: 80583 No. APC140B	5-2
E1		TERMINAL: 81349 No. FT02-1	5-2
R1		RESISTOR: 81349 No. RC20GF820J	5-2
S1		SWITCH, ROTARY: 06181 No. B4150	5-2

MULTIPLIER BOARD ASSEMBLY NO. C4156 UD1A2A3A1

C1		CAPACITOR: 81349 No. CM05F361J03	5-5
C2		CAPACITOR: 81349 No. CM06F472J03	5-5
C3		CAPACITOR: 81349 No. CM06F182J03	5-5
C4		CAPACITOR: 81349 No. CM05F111J03	5-5
C5		CAPACITOR: 81349 No. CM06F222J03	5-5
C6		CAPACITOR: 81349 No. CM06F821J03	5-5
C7		CAPACITOR: 56289 No. TG-P10	5-5
C8		CAPACITOR: 81349 No. CM05E270J03	5-5
C9		CAPACITOR: 81349 No. CM06F102J03	5-5
C10		CAPACITOR: 81349 No. CM05F391J03	5-5
C11		CAPACITOR, VARIABLE: 72982 No. 557-051-34E	5-5
C12		CAPACITOR: 81349 No. CM05F301J03	5-5
C13		CAPACITOR: 81349 No. CM05F131J03	5-5
C14		SAME AS C11	5-5
C15		SAME AS C11	5-5
C16		CAPACITOR: 81349 No. CK60AW102M	5-5
C17		SAME AS C16	5-5
C18		SAME AS C16	5-5
C19		SAME AS C16	5-5
L1		INDUCTOR, VARIABLE: 99800 No. 4000-18	5-5
L2		INDUCTOR, VARIABLE: 99800 No. 4000-10	5-5
L3		INDUCTOR, VARIABLE: 99800 No. 4000-08	5-5
L4		INDUCTOR, VARIABLE: 99800 No. 4000-02	5-5
L8		INDUCTOR: 81349 No. LT4K075	5-5

TABLE 6-1. (Continued)

MULTIPLIER BOARD ASSEMBLY NO. C4156 UD1A2A3A1 (Cont)

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
L9		INDUCTOR: 81349 No. LT4K091	5-5
Q1		TRANSISTOR: 81349 No. 2N1711	5-5
Q2		SAME AS Q1	5-5
Q3		SAME AS Q1	5-5
Q4		SAME AS Q1	5-5
R1		RESISTOR: 81349 No. RC07GF201J	5-5
R3		RESISTOR: 81349 No. RC20GF102J	5-5
R4		RESISTOR: 81349 No. RC20GF431J	5-5
R5		RESISTOR: 81349 No. RC20GF152J	5-5
R6		RESISTOR: 81349 No. RC20GF301J	5-5
R7		SAME AS R5	5-5
R8		RESISTOR: 81349 No. RC20GF331J	5-5
R9		SAME AS R5	5-5
TB1		PRINTED CIRCUIT BOARD: 06181 No. C4144	5-5

OSCILLATOR BOARD ASSEMBLY NO. C4157 UD1A2A3A2			
C1		CAPACITOR: 81349 No. CK63AW103M	5-4
C2		SAME AS C1	5-4
C3		SAME AS C1	5-4
C4		CAPACITOR: 81349 No. CK60AW102M	5-4
C5		CAPACITOR: 81349 No. CM05E270J03	5-4
C6		SAME AS C4	5-4
C8		CAPACITOR: 81349 No. CM05E120J03	5-4
C9		SAME AS C8	5-4
L1		INDUCTOR, VARIABLE: 06181 No. A4116	5-2
L2		INDUCTOR, VARIABLE: 06181 No. A4116-1	5-2
L4		INDUCTOR: 96906 No. MS90539-06	5-4
Q1		TRANSISTOR: 81349 No. 2N1711	5-4
Q2		SAME AS Q1	5-4
Q3		SAME AS Q1	5-4
R1		RESISTOR: 81349 No. RC20GF243J	5-4
R2		RESISTOR: 81349 No. RC20GF182J	5-4
R3		RESISTOR: 81349 No. RC20GF751J	5-4
R4		RESISTOR: 81349 No. RC20GF391J	5-4
R5		RESISTOR: 81349 No. RC20GF302J	5-4
R6		RESISTOR: 81349 No. RC20GF153J	5-4
R7		RESISTOR: 81349 No. RC20GF152J	5-4
R8		RESISTOR: 81349 No. RC20GF103J	5-4
R9		RESISTOR: 81349 No. RC20GF201J	5-4
TB2		PRINTED CIRCUIT BOARD: 06181 No. C4145	5-4
XY1		SOCKET, CRYSTAL: 91506 No. 8000-AG10	5-4
XY2		SAME AS XY1	5-4
Y1		CRYSTAL, 2 MC: 01681 No. A4112	5-4
Y2		CRYSTAL, 3.6 MC: 01681 No. A4112-1	5-4

OSCILLATOR ASSEMBLY NO. C4155-2 UD1A2A4			
A1		MULTIPLIER BOARD ASSEMBLY: 06181 No. C4156	5-2
A2		OSCILLATOR BOARD ASSEMBLY: 06181 No. C4157	5-2
E2		TERMINAL: 81349 No. FT02-1	5-3
S1		SWITCH, ROTARY: 06181 No. B4150-1	5-3

MULTIPLIER BOARD ASSEMBLY NO. C4156 UD1A2A4A1			
		SAME AS 1A2A3A1	

TABLE 6-1. (Continued)

OSCILLATOR BOARD ASSEMBLY C4157 UD1A2A4A2

REF. DESIG.	NOTES	NAME AND DESCRIPTION	FIG. NO.
		SAME AS 1A2A3A2	

TABLE 6-2. LIST OF MANUFACTURERS

MFR. CODE	NAME AND ADDRESS	
02660	Amphenol-Borg Electronics Corp.	Maywood, Illinois
06181	Probescope Co. Inc.	Syosset, New York 11791
56289	Sprague Electric Co.	North Adams, Massachusetts 01247
72982	Erie Technological Products Inc.	Erie, Pennsylvania 16512
75915	Littelfuse Inc.	Des Plaines, Illinois 60016
80583	Hammarlund Mfg. Co.	Mars Hill, North Carolina
81325	General Instrument Co.	Darlington, South Carolina 29532
81349	Military Specifications	
91506	Augat Inc.	Attleboro, Massachusetts 02703
92194	Alpha Wire Corp.	Elizabeth, New Jersey 07207
96906	Military Standards	
99800	Delevan Electronics Corp.	East Aurora, New York 14052

VALIDATION PERFORMANCE

Title of Publication	NAVSHIPS Number 0967-374-3010
Contractor:	Sub-Contractor (if performing validation):
Contract No(s) and Purchase Orders, if applicable	

Chapter	Section	Paragraph	Date Validation Completed	Check here if not validated

Name & Authority of Validating Officer:	Signature of Validating Officer:

VERIFICATION PERFORMANCE

Title of Publication

NAVSHIPS Number
0967-374-3010

Government Activity:

Date Verification Completed:

Date Correction Completed:

Date Reverification Completed:

Chapter	Section	Para	Date Verif Completed	Date Correc-tions made	Date Reverified	Check here if not Verified

Name & Authority of Verifying Officer:

Signature of Verifying Officer:

USER ACTIVITY TECHNICAL MANUAL COMMENT SHEET
NAVSHIPS 5600/2(REV. 9/67)
(Formerly NAVSHIPS 4914)
(COG I - 11-DIGIT STOCK NUMBER: 0105-503-9850)

NAVSHIPS NO. _____
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